

**The Interaction of Segmental-Prosodic Rules with Tonal Rules:  
A Case Study of North Kyungsang Korean\***

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This paper undertakes an investigation into the interaction of segmental-prosodic rules with tonal rules in North Kyungsang Korean (NK Korean). Verb roots in NK Korean are divided into one of three tone classes: the Default H-tone Class, the Floating H-tone Class and the Precoindexed H-tone class. However, segmental-prosodic changes in certain verb stems cause verbs to shift from one tone class to another depending on the nature of the segmental-prosodic modification. These tone changes have been overlooked by all previous studies on NK Korean since they have presented a mixture of NK Korean tones and Seoul Korean segments.<sup>1</sup> This paper will show that all the tonal changes induced by segmental-prosodic changes are explained by the hypothesis that all segmental-prosodic rules affecting the Tone Bearing Unit (TBU) of this language (= the syllable) are applied earlier than tonal rules.

Section 1 briefly deals with the tone system in NK Korean. Section 2 treats the interaction of segmental-prosodic rules with tonal rules. Section 3 highlights the differences between this study and previous studies. Section 4 makes a concluding remark.

**1. Tonal Phonology in NK Korean<sup>2</sup>**

There are three tone classes in NK Korean: (i) the Default H-tone Class, (ii) the Tone Doubling Class, and (iii) the Precoindexed H-tone Class. Stems of the Default H-tone Class consist of two different groups. First, all the stems containing final syllables

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<sup>1</sup> Most educated NK Korean speakers can speak with the Seoul Korean segmental system as well as the NK Korean segmental system. Even though they use the segmental system of Seoul Korean, NK Korean tones are still superimposed on their speech. It might be the main reason why previous studies on NK Korean tonology have made the mistake of mixing the segmental system of Seoul Korean with the NK Korean tone system.

<sup>2</sup> This section is mainly based on my previous studies, N.-J. Kim (1993) and (1994a).

which are heavy belong to this class, e.g., *maknéé* 'the last child (Noun (N))' and *po.néé* 'to send (Verb (V))'. Second, all the stems where H-tones are realized on the penultimate syllable of the stem belong to this class, e.g., *a.pú.éi* 'father (N)' and *pá.li-* 'to throw away (V)'. The tone pattern of this class is predictable, and therefore, stems of this class are assumed to be toneless in the underlying representation (UR).

The rule of H-Insertion (HI) in (1) blindly inserts a H-tone into a toneless stem. This rule is motivated by the fact that NK Korean does not allow words with all L-tones.

(1) H-Insertion (HI)

$\emptyset \rightarrow \text{H} / \text{[ ]}$

The rule of H-Association (HA) in (2) associates a floating H-tone with the appropriate syllable of stems. The appropriate syllable is the final syllable in case it is heavy (e.g. *mak.néé* 'the last child'), and otherwise it is the penultimate syllable (e.g. *a.pú.éi* 'father'). These two syllables can be located by the foot-building process in (2a). Only long vowels are assumed to be heavy in NK Korean: the syllable (C)VC is not counted as a heavy syllable (Y.-H. Chung 1991a and N.-J. Kim 1993). Once the appropriate syllables are located, the H-tone will be associated with the head syllable of the foot by the process in (2b).

(2) H-Association (HA)

- a. Construct a single left-headed foot based on the two moras at the right edge of the domain.
- b. Associate a H-tone with the syllable that is the head of the foot.

Stems of the Tone Doubling Class have H-tones on the initial two syllables, e.g., *ká.éi* 'branch (N)', *hóó.láp.i* 'tiger (N)', *pán.káp-* 'to be glad (V)', and *táá.láp-* 'to be dirty (V)'. This class has no H-tone underlyingly if the stem-initial syllable is heavy, and otherwise has a floating H-tone. The two underlyingly different groups of the stems are classified as the same class since they exhibit the same surface tone pattern. The stem-initial heavy syllables always have a H-tone and therefore this H-tone is predictable. The H-tone is inserted into a toneless stem containing a heavy syllable by the rule of Heavy Syllable H-Insertion (HSH) in (3):

(3) Heavy Syllable H-Insertion (HSH)

$\emptyset \rightarrow \text{H} / \text{[ } \sigma \text{ ]}$   
 $\mu \mu$

A floating H-tone either inserted by the rule of HSH or existing in the UR is associated with the stem-initial syllable by the rule of Initial Tone Association (ITA) in (4). Note that ITA precedes the rule of H-Insertion (HI) in (1). Thus, the H-tone inserted later by HI does not undergo ITA.

(4) Initial Tone Association (ITA)

$\text{H}$   
 $|$   
 $|$   
 $|$   
 $[\sigma]$

The initially-associated H-tone is doubled by the rule of Tone Doubling (TD) in (5):

(5) Tone Doubling (TD)



Stems of the Precoindexed H-tone Class like /mé.nu.li/ 'daughter-in-law,' /sa.ta.li/ 'ladder,' and /pat.təl-/ 'to revere (V)' have a H-tone coindexed with a designated vowel in the UR. After syllabification, the H-tone (originally coindexed with a designated vowel) will be linked to a syllable, the TBU, where the designated vowel is a syllabic nucleus. The precoindexed H-tone on the non-final syllable remains unchanged, as shown in (6):

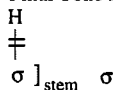
- (6) /mé.nu.li-məŋ.ku.lo/ 'like a daughter-in-law' > mé.nu.li.məŋ.ku.lo  
 /mé.nu.li-e.ke/ 'to a daughter-in-law' > mé.nu.li.e.ke

If there is a precoindexed H-tone on a stem-final light syllable which is followed by a suffix, it appears in a predictable position, as shown in (7a-b). The final H-tone falls on the final heavy syllable when the final syllable is heavy, as shown in (7a). If not, the final H-tone falls on the penultimate syllable of the word, as indicated in (7b).

- (7) a. /ka.či-po.taa/ 'than an eggplant' > ka.či-po.táá  
 b. /ka.či-məŋ.ku.lo/ 'like an eggplant' > ka.či-məŋ.kú.lo  
 /pat.təl-to.lok/ 'to revere + Projective' > pat.təl-tó.lok

For the above tone shift, we need to assume a rule which delinks a H-tone on the stem-final light syllable when the stem is followed by a suffix. In addition, we need to apply the rule of HA cyclically since the delinked H-tones are associated with the syllables predicted by the rule of HA at the word level. Thus, the rule of Final Tone Delinking (FTD) in (8) is proposed. The H-tone may be reassociated with a final heavy syllable by the rule of HA, as in *ka.či-po.táá*, derived from /ka.či-po.taa/ 'than an eggplant,' or it may be associated with the penultimate syllable by the rule of HA, as in *ka.či-məŋ.kú.lo*, derived from /ka.či-məŋ.ku.lo/ 'like an eggplant.'

(8) Final Tone Delinking (FTD)

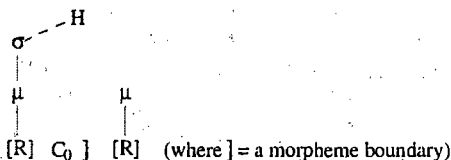


The H-tone on the stem-final light syllable appears to remain unshifted in (9a) where the stem is followed by a vowel-initial suffix. However, there is independent evidence which suggests that a H-tone should be delinked and reassociated with a syllable that is immediately followed by a vowel-initial suffix, as shown in (9b).

- (9) a. /sa.ta.li-e.sə/ 'from a ladder' > sa.ta.li-e.sə  
 /pat.təl-ət-sim.ni-ta/ 'revered + Formal' > pat.təl-ət-sim.ni-ta  
 b. /pat.təl-kes-ə-yo/ 'to revere + Future + Inf + Informal Pol' > pat.təl.ké.sə.yo  
 /pat.təl-kes-ə-to/ 'to revere + Future + Inf + Conce' > pat.təl.ké.sə.to

For this, the rule of Prevocalic Docking (PVD) in (10) is proposed, which associates a H-tone with the syllable that is immediately followed by a vowel-initial suffix:

(10) Prevocalic Docking (PVD)



To sum up, NK Korean has three tone classes and the derivation of the surface tone patterns is accounted for by the seven ordered rules in (11):

- (11) 1. Heavy Syllable H-Insertion (HSH)
2. Initial Tone Association (ITA)
3. Tone Doubling (TD)
4. H-Insertion (HI)
5. Final Tone Delinking (FTD)
6. Pre-Vocalic Docking (PVD)
7. H-Association (HA)

## 2. The Interaction of Segmental-Prosodic Rules with Tonal Rules

This section deals with the interaction of segmental-prosodic rules with tonal rules. The TBU is the syllable in NK Korean (G.-R. Kim 1988 and N.-J. Kim 1994a). There are five types of segmental-prosodic rules which affect the TBU of this language. They are (i) shortening, (ii) glide formation, (iii) syllable deletion, (iv) epenthesis, and (v) syllable fusion (N.-J. Kim 1995). These five types of segmental-prosodic rules induce tonal changes, as outlined in (12). The interaction of segmental-prosodic rules with tonal rules is accounted for by the hypothesis that all the segmental-prosodic rules affecting the TBU of this language must be applied earlier than tonal rules. In (12), a 'spreading' H-tone means a H-tone associated with two TBUs, while a 'non-spreading' H-tone means a H-tone associated with a single TBU.

(12) Tonal Changes Caused by Segmental-Prosodic Changes

	Shortening	Glide Formation	Syllable Deletion	Epenthesis	Syllable Fusion
Tonal Changes	Spreading H-tone → Non-spreading H-tone	Non-spreading H-tone → Spreading H-tone	Non-spreading H-tone → Spreading H-tone	Epenthesis plays significant roles in the application of tonal rules	Syllable fusion does not change the number of moras, and thus no significant tone change follows.

## 2.1 Shortening: Mora Deletion

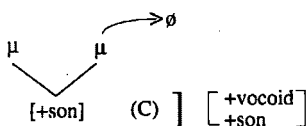
### 2.1.1 Stem Vowel Shortening and Its Interaction with Tones

The stem-final vowels in (13a) are heavy in the UR. However, they are shortened when they are followed by a vowel-initial suffix, as indicated in (13b):<sup>3</sup>

- (13) a. *káám-tá* 'to wind + Ind'  
           *káám-tó.lok* 'to wind + Proj'  
           *káám-nón-ta* 'to wind + Present + Ind'
- b. *kám-ə-lo* 'to wind + Epenthesis *ə* + Obj'  
      *kám-ə-na* 'to wind + Epenthesis *ə* + Adver'  
      *kám-ə-ni* 'to wind + Epenthesis *ə* + Effect'  
      *kám-ət-ta ~ kám-at-ta* 'to wind + Past + Ind'

All dynamic verbs exhibit shortening regardless of the nature of stem-final consonants when they are followed by vowel-initial suffixes. However, the nature of stem-final consonants is significant for stative verbs — if the stem-final consonant is [-son], then shortening is blocked. Based on these observations, the rule of Stem Vowel Shortening (SVS) in (14) is proposed (N.-J. Kim 1995). When the stem is followed by a vowel-initial suffix, the rule of SVS shortens a stem-final long vowel under the condition that [-son] is a blocker when the preceding stem is stative.

#### (14) Stem Vowel Shortening (SVS)<sup>4</sup>



Cond: If the stem is stative and C = [-son],  
 then this rule is blocked.

The rule of SVS and the tonal rule of Prevocalic Docking (PVD) interact with each other. It should be noted that the two rules of SVS and PVD are applied in the same environment, namely before a vowel-initial suffix. It is independently motivated that all stems containing heavy syllables have no H-tones in the UR (Y.-H. Chung 1991a and N.-J. Kim 1994a). The H-tone is inserted into the toneless stems by the rule of Heavy Syllable H-Insertion (HSI). The inserted floating H-tone is associated with the initial

<sup>3</sup> The following abbreviations are used throughout this paper:

Adver = Adversative	Caus = Causative	Con = Conditional	Conce = Concessive
Connec1 = Connective1	Connec2 = Connective2	Effect1 = Effective1	Effect2 = Effective2
Hon = Honorific	Imp1 = Imperative1	Imp2 = Imperative2	Imp3 = Imperative3
Ind = Indicative	Inf = Infinitive	Obj = Objective	Pass = Passive
Pol = Politeness	Proj = Projective	Propo = Propositive	Pros = Prospective
Rel = Relativizer	Retro = Retrospective		

<sup>4</sup> Throughout this paper, Hayes's (1989) moraic theory and Clements & Hume's (1995) theory of feature organization are adopted in formulating rules.

heavy syllable by the rule of Initial Tone Association (ITA) and doubled by the rule of Tone Doubling (TD), as in *káám-tá* 'to wind + Ind.'

If long vowels were shortened by the rule of SVS, then a H-tone could not be inserted by HSH since the stems where the rule of SVS applies contain no heavy syllables — they remain toneless until other tone assignment rules are applied. Since phonetically toneless words are not allowed in NK Korean, the H-tone should be inserted by another independently motivated tonal rule, namely H-Insertion (HI). The inserted H-tone will be associated with a stem-final syllable by the rule of PVD since the following suffix begins with a vowel. In *kám-tta* 'to wind + Past + Ind,' the stem-final syllable is *kám-* since the stem is monosyllabic. Note that PVD is ordered later than TD, and therefore, the H-tone associated by this rule cannot be doubled. As predicted, the word *kám-tta* shows a non-spreading H-tone in the stem. This interaction of the segmental rule of SVS and the tonal rule of PVD is explained by the hypothesis that the rule of SVS precedes tonal rules.

The derivation of surface tonal patterns is given in (15):

(15)		
Gloss:	'to wind + Ind'	'to wind + Past + Ind'
(i) UR:	/kaam-ta/	/kaam-ət-ta/
----- Segmental-Prosodic Phonology		
(ii) SVS:	NA	//kam-ət-ta//
----- Tonal Phonology		
Input:	/kaam-ta/	//kam-ət-ta//
(iii) HSH:	H //kaam-ta//	NA
(iv) ITA:	H   //káám-ta//	NA
(v) TD:	H / \ //káám-tá//	NA
(vi) HI:	NA	H //kam-ət-ta//
(vii) PVD:	NA	H   //kám-ət-ta//
(viii) SR:	<i>káám-tá</i>	<i>ká.mət.ta</i>

## 2.1.2 Derivational Vowel Shortening and Its Interaction with Tones

There are two derivational suffixes which do not begin with vowels. They are the passive suffix and the causative suffix. When these two derivational suffixes are combined with stems, the long vowels in the stem-final syllables exhibit shortening, as shown in (16a-b):

(16)

a. Shortening with the passives

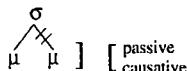
<i>kám-tá</i>	'to wind + Ind'	vs.	<i>kam-kŭ-ta</i>	'to wind + Pass + Ind'
<i>puŭl-tá</i>	'to blow + Ind'	vs.	<i>pul-lŭ-ta</i>	'to blow + Pass + Ind'
<i>áun-tá</i>	'to hug + Ind'	vs.	<i>an-kŭ-ta</i>	'to hug + Pass + Ind'
<i>sŭp-tá</i>	'to chew + Ind'	vs.	<i>sip-hŭ-ta</i>	'to chew + Pass + Ind'

b. Shortening with the causatives

<i>nám-tá</i>	'to overflow + Ind'	vs.	<i>nám-ki-ta</i>	'to overflow + Caus + Ind'
<i>ál-tá</i>	'to know + Ind'	vs.	<i>ál-li-ta ~ al-lŭ-ta</i>	'to know + Caus + Ind'
<i>út-tá</i>	'to laugh + Ind'	vs.	<i>út-ki-ta</i>	'to laugh + Caus + Ind'

This phenomenon is very similar to that of Stem Vowel Shortening, which is discussed in the preceding section. However, there is one crucial difference. These derivational suffixes begin with a consonant, whereas suffixes that trigger the rule of SVS begin with a vowel. Thus, we need to posit an independent rule to account for this phenomenon. Following G.-R. Kim (1988:100) and Y.-H. Chung (1991a:207), N.-J. Kim (1995) proposes a rule of Derivational Vowel Shortening (DVS), which shortens long stem vowels if stems are followed by either the passive or the causative:

(17) Derivational Vowel Shortening (DVS)



The rule of DVS induces the same tonal change as that caused by the rule of SVS: the interaction of DVS and tonal rules is also explained by the hypothesis that the segmental-prosodic rules precede tonal rules. If long vowels were shortened by the rule of DVS, then a H-tone cannot be inserted by HSH since the stems where the rule of DVS has applied contain no heavy syllables. Since phonetically toneless words are not allowed in NK Korean, the H-tone should be inserted by another independently motivated rule, namely H-Insertion (HI). The inserted H-tone should be associated with a TBU by the rule of H-Association (HA). The rule of HA associates a H-tone with the stem-final syllable unless the final syllable is heavy, as in  $\{ /nám-ki/ -ta \}$  'to overflow + Caus + Ind.' If the final syllable is heavy, the H-tone is associated with the final syllable; as in  $\{ /kam-kŭ/ -ta \}$  'to wind + Pass + Ind.' It should be noted that the derivational suffix *-ki* ~ *-kii* and the inflectional suffix *-ta* constitute two separate phonological levels (Y.-H. Chung 1991a and N.-J. Kim 1993). In (18), curly brackets, {}, represent separate derivational and inflectional levels. Note that the H-tone is associated with the predictable syllable regardless of the length of the following inflectional suffixes, as in  $\{ /úl-li/ -sim.ni-a \} \sim \{ /ul-lŭ/ -sim.ni-a \}$  'to cry + Pass + Formality + Ind.' It should be also noted that the rule of HA is ordered later than the rule of Tone Doubling (TD), and therefore, the H-tone associated by the rule of HA cannot be doubled.

The derivation of surface tonal patterns is given below:

- (18)  
 Gloss: 'to wind + Pass + Ind' 'to wind + Pass + Formality + Ind'
- (i) UR: {{kaam-ki}-ta}~{{kaam-kii}-ta} {{uul-li}-sim.ni-ta}~{{uul-lli}-sim.ni-ta}  
 ----- Segmental-Prosodic Phonology
- (ii) DVS: {{kam-ki}-ta}~{{kam-kii}-ta} {{ul-li}-sim.ni-ta}~{{ul-lli}-sim.ni-ta}  
 ----- Tonal Phonology
- Input: {{kam-ki}-ta}~{{kam-kii}-ta} {{ul-li}-sim.ni-ta}~{{ul-lli}-sim.ni-ta}
- (iii) HL: H H H H  
 {{kam-ki}-ta}~{{kam-kii}-ta} {{ul-li}-sim.ni-ta}~{{ul-lli}-sim.ni-ta}
- (iv) PVD: NA NA NA NA
- (v) HA: H H H H  
 | | | |  
 {{kám-ki}-ta}~{{kam-kíi}-ta} {{úl-li}-sim.ni-ta}~{{ul-líi}-sim.ni-ta}
- (vi) SR: *kám-ki-ta ~ kam-kíi-ta úl-li-sim.ni-a ~ ul-líi-sim.ni-a*

## 2.2 Glide Formation and Its Interaction with Tones

The stems in (19a) end with an onsetless syllable. When the onsetless syllable is followed by a vowel-initial suffix, the stem vowel becomes an onset of the following syllable, as shown in (19b):

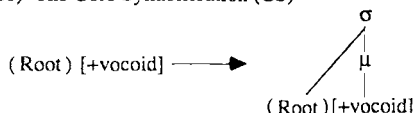
- (19) a. /i-ta/ > *í.ta* 'to carry on the head + Ind'  
 /mo.i-ta/ > *mó.i.ta* 'to gather + Ind'  
 /o-ta/ > *ó.ta* 'to come + Ind'  
 /sa.u-ta/ > *sá.u.ta* 'to fight + Ind'  
 /me.u-ta/ > *mé.u.ta* 'to fill in + Ind'
- b. /i-ə/ > *yə* \**í.ə* 'to carry on the head + Impl'  
 /mo.i-ə/ > *mó.yə* \**mó.i.ə* 'to gather + Impl'  
 /o-ə/ > *wá* \**ó.ə* 'to come + Impl'  
 /sa.u-ə/ > *sá.wə* \**sá.u.ə* 'to fight + Impl'  
 /me.u-ə/ > *mé.wə* \**mé.u.ə* 'to fill in + Impl'

The above phenomenon of glide formation is explained by syllabification theory (N.-J. Kim 1995). If we syllabify the two vowels  $V_1V_2$  as the syllabic nuclei, then two onsetless syllables would be obtained. There is a strong tendency in languages to avoid onsetless syllables. However, if we syllabify  $V_1$  as an onset of the following vowel  $V_2$ , then we obtain the most preferred syllable structure CV. Furthermore,  $V_1$  cannot be



syllabified as an onset of the following V<sub>2</sub> when V<sub>1</sub> is preceded by a consonant due to a general tendency of avoiding complex onsets. Following Steriade (1984), the rule of Core Syllabification (CS) in (20) is adopted:<sup>5</sup>

(20) The Core Syllabification (CS)

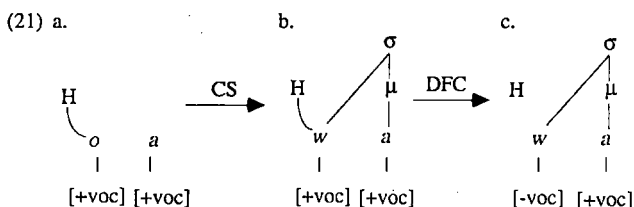


The rule of CS interacts with tonal rules. The rule of CS does not induce tonal changes unless the vowel that is syllabified as an onset by the rule of CS contains a H-tone in the UR. For instance, the H-tone is realized on the penultimate syllable of the stems like *mó.i-* 'to gather' and *sá.u-* 'to fight.' In section 1, it was argued that all the stems having H-tones on the penultimate syllables do not have any underlying H-tones. Thus, the syllable that is syllabified as an onset, i.e., the second syllable of stems like *mó.i-* and *sá.u-* has no underlying H-tone. Therefore, as predicted, no tonal changes follow the rule of CS, as shown in words like *mó.yət.ta* 'to gather + Past + Ind' and *sá.wət.ta* 'to fight + Past + Ind.'

If the vowel that is syllabified as an onset by the rule of CS contains a H-tone in the UR, CS induces tonal changes. NK Korean has two kinds of underlying H-tones — floating H-tone and preindexed H-tone. First, if the vowel that is syllabified as an onset by the rule of CS has a floating H-tone in the UR, it cannot bear a H-tone since it becomes a glide. Thus, the H-tone will be associated with the syllable that is built on the following vowel by the rule of Initial Tone Association (ITA), and doubled by the rule of Tone Doubling (TD). The stem /o-/ 'to come,' which has a floating H-tone in the UR, behaves as predicted. Note that the H-tone is realized on the initial two syllables in *ó.tá.la* 'to come + Retro,' where CS has not applied. The H-tone is also realized on the initial two syllables in *wát.tá* 'to come + Past + Ind,' where CS has applied. This example shows that the prosodic rule CS must be applied earlier than tonal rules. Otherwise, we would be obliged to assume a tone shift rule which would explain the tone change of *ó-át-ta* 'to come + Past + Ind' to *wát.tá*.

Second, if a vowel which is coindexed with a H-tone becomes an onset of the following syllable by the rule of CS, then the vowel becomes a glide. Cross-linguistic evidence has shown that there is a difference between vocalic and consonantal glides (Hume 1993). Furthermore, Herman (1994) shows that there are two phonetically identical but phonologically distinct labial glides within a language, Karuk. I assume that glides are consonantal, [-vocoid], in NK Korean. After a vowel becomes a glide, the feature [+vocoid] will be replaced by [-vocoid] by the default feature-changing rule. The [-vocoid] segment no longer sponsors a H-tone. Thus, the coindexing between the vowel and the H-tone is lost, and therefore, the H-tone becomes a floating H-tone. These processes are illustrated in (21):

<sup>5</sup> Short vowels are assumed to have no specification of moras in the UR, whereas long vowels are specified as having two moras in the UR. The moraic value, one mora, will be given to a short vowel only when the short vowel occurs in the syllabic nucleus position. Therefore, this rule does not induce compensatory lengthening even when the first segment is [+vocoid] in the structural description. It happens in a number of languages that compensatory lengthening does not follow glide formation when glide formation is correlated with the lack of the onset, e.g., Latin (Steriade 1984), Romanian (Steriade 1984) and Kikerekw (Odden 1995).



The floating H-tone will be realized on the initial two syllables by ITA and TD, which are independently motivated (G.-R. Kim 1988, Y.-H. Chung 1991a, N.-J. Kim 1994a).

As predicted, the stem /i-/ 'to carry on the head' exhibits such a tonal change. The stem /i-/ shows a non-spreading H-tone, as shown in (22a-b). In (22b), H-tones shift rightward and are realized on the penultimate syllable of the word. This stem belongs to the Precoindexed H-tone Class (N.-J. Kim 1993).

- (22) a. *i-ta* 'to carry on the head + Ind'  
*i-ni* 'to carry on the head + Effect'  
*i-mən* 'to carry on the head + Con'
- b. *i-két-ta* 'to carry on the head + Future + Ind'  
*i-tó.lok* 'to carry on the head + Proj'  
*i-ket-sim.ni-ta* 'to carry on the head + Future + Formality + Ind'

When CS has applied, the H-tone is realized on the initial two syllables, as in (23). This tonal change can be explained if we assume that the prosodic rule of CS is applied earlier than tonal rules.

- (23) *i-ət-ta/* > *yət.tá* 'to carry on the head + Past + Ind'  
*i-ə-sə/* > *yəs.sə* 'to carry on the head + Inf + Connect'  
*i-ə-to/* > *yət.tó* 'to carry on the head + Inf + Conce'  
*i-ə-yo/* > *yət.yó* 'to carry on the head + Inf + Informal Pol'

The derivation of surface tone patterns is given below:

- (24) Gloss: 'to carry on the head + Past + Ind' 'to come + Past + Ind'
- (i) UR: 
  
 ----- Segmental-Prosodic Phonology
- (ii) DS: 
  
 (iii) CS & DFC:

## ----- Tonal Phonology

(iv) Input:	H	H
	/y-ət-ta/	/w-at-ta/
(v) ITA:	H	H
	/y-ət-ta/	/w-át-ta/
(vi) TD:	H	H
	/ \	/ \
	/y-ət-tá/	/w-át-tá/
(vii) SR:	yət.tá	wát.tá

## 2.3 Syllable Deletion and Its Interaction with Tonal Rules

The past suffix is /-ət/, as shown in words like *mə́kə́tta*, derived from /mæk-ət-ta/ 'to eat + Past + Ind'. When the preceding stem ends with the vowel [a], it might appear that the vowel ə in /-ət/ is deleted, as shown in (25):

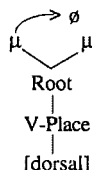
- (25)
- |            |   |        |                           |
|------------|---|--------|---------------------------|
| /ča-ət-ta/ | > | čát.tá | 'to sleep + Past + Ind'   |
| /ka-ət-ta/ | > | kát.tá | 'to go + Past + Ind'      |
| /na-ət-ta/ | > | nát.tá | 'to be born + Past + Ind' |

However, NK Korean has the rule of Dorsal Spreading by which /ə/ harmonizes to the dorsality of the preceding stem vowel [o] or [a] and therefore the underlying vowel /ə/ is realized as [a]. Therefore, there is an intermediate representation between the underlying representation and the surface representation, as indicated in (26):

- (26)
- |            |   |              |   |        |                           |
|------------|---|--------------|---|--------|---------------------------|
| UR         |   | IR           |   | SR     |                           |
| /ča-ət-ta/ | > | //ča-at-ta// | > | čát.tá | 'to sleep + Past + Ind'   |
| /ka-ət-ta/ | > | //ka-at-ta// | > | kát.tá | 'to go + Past + Ind'      |
| /na-ət-ta/ | > | //na-at-ta// | > | nát.tá | 'to be born + Past + Ind' |

Assuming the derivation in (26), we can argue that the stem vowel [a] instead of the past suffix vowel [ə], is deleted. N.-J. Kim (1995) proposes that the first [a] is deleted by the rule in (26) when the vowel cluster *aa* is derived by the rule of Dorsal Spreading. It will be shown that we encounter a problem if we alternatively assume that the second suffix vowel *a* is deleted. Note that this rule is applied only to the derived vowel cluster [aa] since the underlyingly long /aa/ remains unshortened, as in *đún.tá* 'to hug + Ind.'

- (27) *a*-Deletion (*a*-DEL)

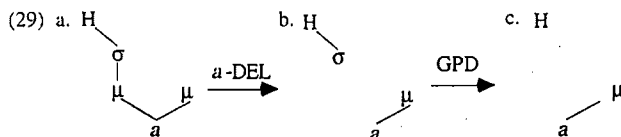


When the first mora is deleted, the syllable structure on that mora will be subsequently deleted by the principle of Generalized Parasitic Delinking (GPD) stated in (28). GPD is a generalized version of Hayes' (1989) Parasitic Delinking.<sup>6</sup>

(28) Generalized Parasitic Delinking (GPD)

Syllable structure is deleted when the syllable contains no overt nuclear element (mora or a nuclear segment).

The rule of *a*-Deletion also interacts with tonal rules. First, if the stem has a precoindeixed H-tone in the UR, then the H-tone would become a floating H-tone since the docking place of the H-tone is deleted by *a*-DEL and GPD, as shown in (29):



The stem /sá-/ 'to buy' exhibits such a tonal change. In (30), the stem /sá-/ is shown to have a non-spreading H-tone:

- |      |                |                    |                 |                   |
|------|----------------|--------------------|-----------------|-------------------|
| (30) | <i>sá-ta</i>   | 'to buy + Ind'     | <i>sá-ni</i>    | 'to buy + Effec1' |
|      | <i>sú-ko</i>   | 'to buy + Connec2' | <i>sa-kála</i>  | 'to buy + Imp3'   |
|      | <i>sa-tóla</i> | 'to buy + Retro'   | <i>sa-tólok</i> | 'to buy + Propo'  |

However, it shows a spreading H-tone in the words where the rule of *a*-DEL has applied, as shown in (31).

- |      |            |   |              |   |              |                               |
|------|------------|---|--------------|---|--------------|-------------------------------|
| (31) | /sá-ət-ta/ | > | //sá-at-ta// | > | <i>sáttá</i> | 'to buy + Past + Ind'         |
|      | /sá-ə-la/  | > | //sá-a-la//  | > | <i>sálá</i>  | 'to buy + Inf + Imp2'         |
|      | /sá-ə-sa/  | > | //sá-a-sa//  | > | <i>sásś</i>  | 'to buy + Inf + Connec1'      |
|      | /sá-ə-to/  | > | //sá-a-to//  | > | <i>sátó</i>  | 'to buy + Inf + Conce'        |
|      | /sá-ə-yo/  | > | //sá-a-yo//  | > | <i>sáyó</i>  | 'to buy + Inf + Informal Pol' |

This tonal change is explained by the assumption that *a*-DEL and GPD are applied earlier than tonal rules. If we alternatively assume that the suffix vowel, instead of the stem vowel, is deleted, then it is hard to explain the subsequent tonal changes induced by the rule of *a*-Del. This is the reason of why I assume that the stem vowel [a], instead of the suffix vowel [a], is deleted.

On the other hand, the stems in (32) have a floating H-tone underlyingly so that these stems exhibit a spreading H-tone regardless of the application of *a*-DEL and GPD, as shown in (32a-b). This fact is also explained by the hypothesis that the segmental and prosodic rules of *a*-DEL and GPD are applied earlier than tonal rules.

- |         |                          |                             |                            |                           |
|---------|--------------------------|-----------------------------|----------------------------|---------------------------|
| (32) a. | <i>t<sup>h</sup>á-tá</i> | 'to get on + Ind'           | <i>t<sup>h</sup>á-ní</i>   | 'to get on + Effec1'      |
|         | <i>t<sup>h</sup>á-kó</i> | 'to get on + Connec2'       | <i>t<sup>h</sup>á-kála</i> | 'to get on + Imp3'        |
| b.      | <i>t<sup>h</sup>áttá</i> | 'to get on + Past + Ind'    | <i>t<sup>h</sup>álá</i>    | 'to get on + Inf + Imp2'  |
|         | <i>t<sup>h</sup>ásś</i>  | 'to get on + Inf + Connec1' | <i>t<sup>h</sup>átó</i>    | 'to get on + Inf + Conce' |

<sup>6</sup> Parasitic Delinking (Hayes 1989:268)

Syllable structure is deleted when the syllable contains no overt nuclear segment.

The derivation of surface tonal patterns is given below:

- (33)  
 Gloss: 'to buy + Past + Ind'                      'to get on + Past + Ind'  
 (i) UR:                      H    H  
                                  |    |  
                                  /sá-ət-ta/    /t<sup>h</sup>a-ət-ta/

----- Segmental-Prosodic Phonology

- (ii) DS:                      H    H  
                                  |    |  
                                  //sá-at-ta//    //t<sup>h</sup>a-at-ta//  
 (ii) a-DEL &                      H    H  
 GPD:                      ‡    |  
                                  //sø-at-ta//    //t<sup>h</sup>ø-at-ta//

----- Tonal Phonology

- (iii) ITA:                      H    H  
                                  |    |  
                                  //sø-át-ta//    //t<sup>h</sup>ø-át-ta//  
 (iv) TD:                      H    H  
                                  / \    / \  
                                  //sø-át-tá//    //t<sup>h</sup>ø-át-tá//  
 (v) SR:                      sáttá    t<sup>h</sup>áttá

## 2.4. Epenthesis

NK Korean has nine suffixes that show an ə/ø alternation. The schwa appears when the preceding stem ends with a [-approximant] consonant, as in (34). The [-approximant] consonants includes all consonants except liquids and glides.

- (34) Relativizer                      -ən                      čáp-ən- 'to catch + Rel'  
 Honorific                      -əsi                      čáp-əsi- 'to catch + Hon'  
 Prospective                      -əl                      čáp-əl- 'to catch + Pros'  
 Objective                      -əlo                      čáp-əlo 'to catch + Obj'  
 Effective1                      -əni                      čáp-əni 'to catch + Effec1'  
 Effective2                      -ənik'a                      čáp-ənik'a 'to catch + Effec2'  
 Conditional                      -əmən                      čáp-əmən 'to catch + Con'  
 Formal Propositive                      -əso                      čáp-əso 'to catch + Propo'  
 Adversative                      -əna                      čáp-əna 'to catch + Adver'

When the preceding stem ends with a vowel or a liquid, the ø (zero) form appears, as shown in (35a-b). In (35b), it is shown that the stem-final /l/ is deleted by the process of /l/-Deletion when it is followed by /n/ or /s/ (N.-J. Kim 1994b). Note that /ə/ is not inserted after /l/ even though /l/ is not deleted in *úúl.mən* 'to cry + Con.'

## (35) a. the zero form after a vowel

Relativizer	-n	čá-n- 'to sleep + Rel'
Honorific	-si	čá-sí- 'to sleep + Hon'
Prospective	-l	čá-l- 'to sleep + Pros'
Objective	-lo	čá-lo 'to sleep + Obj'
Effective1	-ni	čá-ni 'to sleep + Effec1'
Effective2	-nik'a	čá-nik'a 'to sleep + Effec2'
Conditional	-mən	čá-mən 'to sleep + Con'
Formal Propositive	-so	čá-só 'to sleep + Propo'
Adversative	-na	čá-na 'to sleep + Adver'

## b. the zero form after //

Relativizer	-n	úú-n- 'to cry + Rel'
Honorific	-si	úú-sí- 'to cry + Hon'
Prospective	-l	úú-l- 'to cry + Pros'
Objective	-lo	úú-ló 'to cry + Obj'
Effective	-ni	úú-ní 'to cry + Effec1'
Effective2	-nik'a	čá-nik'a 'to cry + Effec2'
Conditional	-mən	úú-mən 'to cry + Con'
Formal Propositive	-so	úú-só 'to cry + Propo'
Adversative	-na	úú-ná 'to cry + Adver'

It is proposed that /ə/ is epenthesized between a [-approximant] consonant and a consonant (N.-J. Kim 1995). The above rule must be morphologically conditioned since /ə/ is epenthesized only when one of the above-mentioned nine morphemes follows the stem.

## (36) ə-Epenthesis (ə-EPEN)

∅ → ə / [ -approximant ] + \_\_\_\_\_

Prospective /-l/  
 Relativizer /-n/  
 Honorific /-si/  
 Objective /-lo/  
 Adversative /-na/  
 Effective1 /-ni/  
 Effective2 /-ni.k'a/  
 Conditional /-mən/  
 Propositive1 /-so/

Let me now consider the interaction of ə-Epenthesis and tonal rules. If the stem has a floating H-tone in the UR, it is always realized on the initial two syllables regardless of the application of ə-Epenthesis, as shown in (37a-b). This tonal pattern is explained by the hypothesis that the segmental rule ə-Epenthesis is ordered earlier than tonal rules.

- (37) a. č<sup>h</sup>ám-tśla 'to endure + Retro'  
           č<sup>h</sup>ám-kśla 'to endure + Imp3'  
           č<sup>h</sup>ám-tólok 'to endure + Propo'  
           č<sup>h</sup>ám-sípni-ta 'to endure + Formality + Ind'
- b. č<sup>h</sup>ám-ə-si- 'to endure + Hon'  
       č<sup>h</sup>ám-ə-lo- 'to endure + Obj'  
       č<sup>h</sup>ám-ə-ni- 'to endure + Effec1'  
       č<sup>h</sup>ám-ə-mən- 'to endure + Con'  
       č<sup>h</sup>ám-ə-na 'to endure + Adver'

On the other hand, if the stem has a preindexed H-tone in the UR, the H-tone shifts to the penultimate syllable of the word unless the suffix begins with a vowel, as shown in (38a). This tonal shift is explained by the two tonal rules, Final Tone Delinking (FTD) and H-Association (HA). However, the H-tone remains unshifted when ə is epenthesized between the stem and the suffix, as shown in (38b). This tonal pattern is also explained by the assumption that the segmental rule of ə-Epenthesis precedes the tonal rule of Prevocalic Docking (PVD). PVD reassociates a delinked H-tone with the stem-final syllable when the following suffix begins with a vowel.

- (38) a. /mák-təla/ > mək-təla 'to eat + Retro'  
 /mák-kəla/ > mək-kəla 'to eat + Imp3'  
 /mák-tolok/ > mək-təlok 'to eat + Proj'  
 /mák-sip.ni-ta/ > mək-sipni-ta 'to eat + Formality + Ind'
- b. /mák-si-/ > //mək-ə-si-// > mək-ə-si- 'to eat + Hon'  
 /mák-lo-/ > //mək-ə-lo-// > mək-ə-lo- 'to eat + Obj'  
 /mák-ni-/ > //mək-ə-ni-// > mək-ə-ni- 'to eat + Effect1'  
 /mák-nik'a-/ > //mək-ə-nik'a-// > mək-ə-nik'a- 'to eat + Effect2'  
 /mák-mən-/ > //mək-ə-mən-// > mək-ə-mən- 'to eat + Con'  
 /mák-so/ > //mək-ə-so// > mək-ə-so 'to eat + Formal Propo'  
 /mák-na/ > //mək-ə-na// > mək-ə-na 'to eat + Adver'

The derivation of surface tone patterns is given below:

- (39)  
 Gloss: 'to eat + Effect2' 'to endure + Con'  
 (i) UR: H H  
 |  
 /mák-nik'a/ /č<sup>h</sup>am-mən/  
 ----- Segmental-Prosodic Phonology
- (ii) Epenthesis: H H  
 |  
 //mák-ə-nik'a// //č<sup>h</sup>am-ə-mən//  
 ----- Tonal Phonology
- Input: H H  
 |  
 //mák-ə-nik'a// //č<sup>h</sup>am-ə-mən//
- (iii) ITA: NA H  
 |  
 //č<sup>h</sup>am-ə-mən//
- (iv) TD: NA H  
 / \  
 //č<sup>h</sup>am-ə-mən//

- (v) FTD:                    H  
                              ‡                    NA  
                              //mək-ə-nik'a//
- (vi) PVD:                    H  
                              |                    NA  
                              //mək-ə-nik'a//
- (vii) SR:                    məkənɨk'a                    ɕʰámámən

## 2.5 Syllable Fusion and Its Interaction with Tones

The suffix-initial /ə/ undergoes Dorsal Spreading: it becomes /a/ when the preceding stem-vowel is /o/ or /a/. When the stem vowel is /a/, then the stem vowel *a* of the derived vowel cluster /aa/ is deleted by *a*-Deletion (*a*-DEL), as already discussed in 2.3. When vowels like /ə/ and /a/ are immediately preceded by other vowels, the rule of Syllable Fusion occurs, as shown in (40). The subsequent segmental changes which occur in (40) can be explained by segmental rules.<sup>7</sup> However, this paper does not deal with those segmental rules in detail since they do not cause any prosodic change, and thus they are not relevant to the discussion.

- (40) a. /čũ-ət-sim.ni-ta/ > čóót.sim.ni.ta 'to give + Past + Formality + Ind'  
           /so-ət-sim.ni-ta/ > sóót.sim.ni.ta 'to shoot + Past + Formality + Ind'  
           //pi-ət-sim.ni-ta// > píít.sim.ni.ta 'to be empty + Past + Formality + Ind'  
           /ke-ət-sim.ni-ta/ > kéét.sim.ni.ta 'to make a bed + Past + Formality + Ind'  
           /sə-ət-sim.ni-ta/ > séét.sim.ni.ta 'to stand+ Past + Formality + Ind'
- b. /po-ə/ >                    paa \*poo 'to see + Impl'  
      /p<sup>h</sup>u-ə/ >                    p<sup>h</sup>əə \*p<sup>h</sup>oo \*p<sup>h</sup>uu 'to scoop up + Impl'  
      /puC-ə/ >                    pəə \*poo \*puu 'to pour + Impl'  
      /puuC-ə/ >                    //puC-ə// > pəə \*poo \*puu 'to pour + Impl'

The rule of Syllable Fusion fuses two monomoraic syllables into one dimoraic syllable when the two vowels occur strictly adjacently. Note that the second syllable is

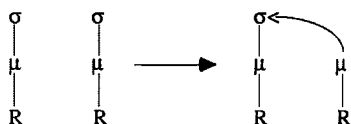
<sup>7</sup> In (40a), the root node of /ə/ or /a/ is delinked and the preceding vowel is compensatorily lengthened. Furthermore, when the sequence /u+ə/ occurs as in /čũ-ət-sim.ni-ta/ 'to give + Past + Formality + Ind', the output is *oo* rather than *uu*, as shown in *čóót.sim.ni.ta*. For this reason, I assume that the derived /uu/ becomes lowered by an Adjustment Rule, which operates after Compensatory Lengthening. Note that only the derived /uu/ becomes lowered since any non-derived /uu/ remains unchanged as in *úúl-tá* 'to cry + Ind'. For these phenomena, the three segmental rules of Suffix Vowel Delinking (SuVD), Compensatory Lengthening, and Adjustment Rule are motivated in N.-J. Kim (1994b).

In (40b), /puC-/ 'to pour' and /puuC-/ 'to swell', have empty C-slots, and the two empty C-slots end in zero forms when the following suffix begins with a vowel (N.-J. Kim 1994b & 1995). The long vowel in /puuC-/ 'to swell' is shortened by Stem Vowel Shortening discussed in 2.1.1. The root node of the stem vowel appears to be delinked and compensatory lengthening seems to operate from right to left after Dorsal Spreading has applied. For these phenomena, a rule of Stem Vowel Delinking (StVD) is motivated, and the mirror-image rule of Compensatory Lengthening is proposed in N.-J. Kim (1994b) & (1995). If we compare StVD to SuVD, StVD is a more specific rule, and therefore, it is applied before the more general rule SuVD.



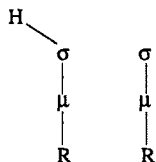
onsetless, and therefore it is unstable. This is the reason why the first syllable survives the rule of SF.

(41) Syllable Fusion (SF)

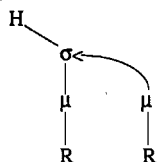


The prosodic rule of SF interacts with tonal rules. The process of SF destroys the second syllable but keeps the first one. Note that the second syllable is a suffix, and that all suffixes are toneless. The first syllable can bear a H-tone, but it remains undestroyed. Therefore, this process will not cause any significant tonal changes. If the stem vowel has a preindexed H-tone underlyingly, the structure in (42b) will be obtained after the prosodic rule of SF has applied. The preindexed H-tone on the first syllable remains as it is, but it is now realized on the heavy syllable.

(42) a.



b.



As predicted, the stem /mé-/ 'to fasten,' which has a preindexed H-tone in the UR, shows no significant tone change, as shown in *méetta* derived from /mé-ət-ta/ 'to fasten + Past + Ind' — the H-tone is realized on the initial heavy syllable. The stem /púC-/ 'to pour,' which also has a preindexed H-tone in the UR, shows no significant tone change, as shown in *páetta* derived from /púC-ət-ta/ 'to pour + Past + Ind,' in which the H-tone is realized on the initial heavy syllable. This fact is explained by the hypothesis that all the segmental-prosodic rules are applied earlier than tonal rules.

On the other hand, if the stem has a floating H-tone, it is realized on the initial two syllables. As predicted, the stem /so-/ 'to shoot,' which has a floating H-tone in the UR, exhibits a H-tone in the initial two syllables, as in *sóttá* derived from /so-ət-ta/ 'to shoot + Past + Ind.' However, if tonal rules applied first, then it would be unnecessary to explain why the final syllable -*tá* has a H-tone in *sóttá*.

The derivation of surface tone patterns is given below:

(43)

Gloss:

'to fasten + Past + Ind'

'to shoot + Past + Ind'

(i) UR:

H

H

/mé-ət-ta/

/so-ət-ta/

## ----- Segmental-Prosodic Phonology

(ii) SF & subsequent segmental rules:	H   //méét-ta//	H  //soot-ta//
--	-----------------------	----------------------

## ----- Tonal Phonology

Input:	H   //méét-ta//	H  //soot-ta//
(iii) ITA:	NA	H   //sóót-ta//
(iv) TD:	NA	H / \ //sóót-tá//
(v) SR:	méétta	sóóttá

## 3. Comparison with Previous Studies

All previous analyses of the NK Korean tonal system like K. Chung (1980), Narahara (1985), G.-R. Kim (1988), and Y.-H. Chung (1991a) have made a mistake of mixing the segmental system of Seoul Korean with the NK Korean tonal system, thus obscuring some interesting facts about tones and segments within NK Korean.

Certain verbs may be spoken segmentally in two different ways, i.e., (i) with the NK Korean segmental system as in (44b) below and (ii) with the Seoul Korean segmental system as in (44c) below. Note that the two verbs /su-ət-ta/ 'to make a soup + Past + Ind' and /so-ət-ta/ 'to shoot + Past + Ind' are neutralized into *soot.ta* when spoken with the NK Korean segmental system, while they do not neutralize when spoken with the Seoul Korean segmental system. The more interesting problem is that words show different tonal patterns depending on the difference in segments. When spoken with the NK Korean segmental system, a spreading H-tone is used in *sóót.tá*. However, a non-spreading H-tone is used when spoken with the Seoul segmental system, as in *sú.ət.ta* and *só.at.ta*. Previous studies based on such data as *sú.ət.ta* and *só.at.ta* (i.e., the mixture of the NK Korean tonal system and the Seoul Korean segmental system) ignored two empirically significant issues. First, segmental changes in *sóót.tá* were left unexplained. Second, the subtle tonal difference between *sóót.tá* and *sú.ət.ta* and *só.at.ta* was also left unaccounted for. Consequently, the interaction of segmental-prosodic rules with tonal rules was largely ignored.

(44)

a. UR	b. with NK Korean Segments	c. with Seoul Korean Segments
/su-ət-ta/ 'made a soup'	<i>sóót.tá</i>	<i>sú.ət.ta</i>
/so-ət-ta/ 'shot'	<i>sóót.tá</i>	<i>só.at.ta</i>

#### 4. Conclusion

Segmental-prosodic changes in certain verb stems cause verbs to shift from one tone class to another depending on the nature of the segmental-prosodic modification. This paper has shown that all the tonal changes caused by segmental-prosodic changes are explained by the hypothesis that all segmental-prosodic rules affecting the TBU of this language are applied earlier than tonal rules.

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